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AUTHOR Somekh, Bridget; Mavers, Diane; Lewin, Cathy
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ABSTRACT

This paper examines the impact of networked technologies on educational reform in the context of linking home and school within this context of political and social struggle. The theoretical framework is presented first, grounding the study in an understanding of the curriculum as an educational process that is currently subject to challenge as a result of the very radical changes to students' access to information and cultural artifacts through technology. The methodology for the study is then presented, followed by evidence that suggests that a transition is in progress in terms of "the process curriculum." The different ways in which technology facilitates flexible working approaches are then discussed. Three accounts from case study schools are explored more deeply to provide concrete examples of how technology is acting as a catalyst for reform where there is a degree of cultural harmony between home and school; the first describes the impact of technology on existing cultural discourse and social practices; the second exemplifies the use of technology to support learning beyond the school walls; and the third is an example of how technology can support gifted and talented students. The effect of inequalities of access to technology in the home on teaching practices and students' use of technology is then discussed. The final section of the paper draws out the implications of the conflict and tensions being faced as technology becomes embedded in an educational system that is grounded in socio-political struggle. Questions are raised for the participants about comparable conflicts and tensions in curriculum policy and educational practice in the United States. (Contains 42 references.) (AEF)

Broadening access to the curriculum through using technology to link home and school: a critical analysis of reforms to improve educational attainment for all K-12 students

Bridget Somekh, Diane Mavers and Cathy Lewin
Manchester Metropolitan University

Introduction

The Department for Education and Skills (DfES) in England, UK, commissioned a small-scale exploratory study on the use of technology to support links between school and home (from February to August 2001). It was designed to inform government about early developments in innovative practice which might have important implications for national policy. The contractual aims of the research were:

1. To describe and analyse existing practice in using technology to develop new links between home and school across the whole elementary and high school (5-18) age range.
2. To explore the ways in which such technology-based links could broaden access to the curriculum for all students and improve levels of educational attainment.
3. To consider the implications of these developments for decision makers, schools, administrators, students and parents, and provide advice on good practice.

In addition, the research provided an opportunity:

4. To critically examine the assumptions about curriculum, pedagogy and the value-free nature of technology which underpin current UK policies for educational reform.
5. To explore the impact on the curriculum-in-practice of the use of technology across the home-school divide.

Dissemination to the wider educational community intends to provide insights into models of implementation from which other schools will be able to make judgements about the strategies most likely to suit their needs. As an early national study in this area, the research also identifies gaps in knowledge and provides a starting point for future work. It was published by government in February 2002 (Somekh, Mavers and Lewin, 2002).

At a meta-level, our research was located in the current debate in the UK about the validity and value of educational research (Hillage, 1998; Freedman et al, 2000). The methodological challenge was to provide a fair, evidence-based analysis of the potential for using technology in the home to extend access to the curriculum and enrich opportunities for all young people, while engaging critically with the social and cultural issues arising from the early implementation of this reform in practice. The politicisation of education and educational reform is the dominant feature that frames current educational research and evaluation in the UK. Policy under our current labour government is dominated by two conflicting imperatives – the traditional labour vision of education as the gateway to equity and social justice, defined in terms of access to qualifications and jobs, and the marketised commodification of both knowledge (in a centrally defined discipline-based national curriculum and high stakes testing) and the social practices of schooling (pedagogy and administration) within an audit culture

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grounded in assumptions of performativity. A current government consultation document on proposed educational reform for 14-19 year olds reflects both positions (DfES, 2002a). Whilst these proposals focus on a more flexible curriculum including more recognition for vocational qualifications thus enabling all learners to achieve some degree of success, the driving forces are perceived to include targets and performance measures. The tensions between these two reform imperatives reflect the political need for the government to retain support from both its traditional left wing supporters (the labour party, the trade unions and socialist intellectuals) and the powerful interest groups of the right (business leaders, entrepreneurs and the right wing 'establishment') whose support is essential to maintain confidence in the economy. Drawing on Popkewitz (2000) this kind of ambiguity at the heart of education policy can be seen as a typical problem of advanced Western democracies. In our research, we were aware that the social transformation in the nature of knowledge, as constructed by its production and use mediated by technology, in the media, the world of commerce and business, and the working practices of public figures including politicians, is not being transferred to the education system. Instead traditional definitions of the knowledge that 'counts' in our society underpin the specified national curriculum with its attainment targets and high stakes national tests (used to locate schools' performance in published 'league tables' of test scores). Yet the use of the internet and a wide range of associated technologies by families, and perhaps especially children and young people, place them at the centre of this process of knowledge transformation in society.

Technology plays a unique role as the unifying 'big idea' that policy-makers believe will deliver raised educational performance in test scores and at the same time open up opportunities for all in a more just and inclusive education system. The UK government has strong beliefs that technology will play a major role in transforming learning, facilitating access at anytime and from anywhere to tutoring, educational communities and resources that may be tailored to individual students needs (DfES, 2002b). Within this broad aspiration, technology used to link home and school, can be seen as a mechanism for transforming relationships between parents and teachers, using 'the seductive rhetoric in contemporary reform (...) of participation, collaboration, and democratization.' (Popkewitz op cit, p.25). However, there are mismatches between the independent ethic that characterises young people's use of technology in the home and the traditional approach of the education system to curriculum and pedagogy. As it forges these new links, the education system is unwittingly opening up these traditional approaches to challenge. The vision of improved partnership with parents is also naïve in its disregard of the socio-cultural factors which make schools in England alien to many parents. The structuring of English society by deep-rooted allegiances to, and reactions against, the cultures of social class make it exceptionally difficult for schools to re-position themselves as extensions to family life. As McNamara et al (2000) show, there are strong social and cultural factors which are likely to 'mobilise'/'demobilise' the various stakeholders to block any fundamental change in home-school relationships.

This paper examines the impact of networked technologies on educational reform in the context of linking home and school within this context of political and social struggle. The theoretical framework is presented first, grounding the study in an understanding of

the curriculum as an educational process which is currently subject to challenge as a result of very radical changes to students' access to information and cultural artifacts through technology. The methodology for the study is then presented, followed by evidence that suggests that a transition is in progress in terms of 'the process curriculum' (Stenhouse 1975). The different ways in which technology facilitates flexible working approaches are then discussed. Three accounts from case study schools are explored more deeply to provide concrete examples of how technology is acting as a catalyst for reform where there is a degree of cultural harmony between home and school: the first describes the impact of technology on existing cultural discourses and social practices; the second exemplifies the use of technology to support learning beyond the school walls; and the third is an example of how technology can support gifted and talented students. The effect of inequalities of access to technology in the home on teaching practices and students' use of technology is then discussed. The final section of the paper draws out the implications of the conflict and tensions being faced as technology becomes embedded in an educational system that is grounded in socio-political struggle. Questions are raised for the participants about comparable conflicts and tensions in curriculum policy and educational practice in the USA.

Theoretical Framework

Our starting point was the curriculum theory of Elliott, itself grounded in the work of Stenhouse (1975) and Bruner (1970). Elliott suggests that knowledge can be:

'represented in schools to children, not as information to be transmitted but as structures of ideas, principles and procedures which support creative and imaginative thinking about human experience.' (Elliott, 1998, p. 22)

He points out that this form of pedagogy is incompatible with a curriculum that is specified in terms of large amounts of content that must be learned in preparation for tests. The new construction of the student as independent learner, able through technology at home and at school to access vast amounts of information in the form of text and a range of images, makes sense only if the curriculum is defined as *a process* of engaging students' minds with knowledge that has not been pre-specified (Stenhouse, 1975, pp 84-97). The educational question raised by the penetration of technology into the home then becomes how to support students in identifying their own learning goals, planning and structuring their research, learning to discriminate between information from different sources (whether it is obtained from books, teachers or technology-based sources), linking information and theories to practical experiments (in school/laboratory or in life), and reconstructing knowledge for presentation to others (orally, on paper, or in a technology environment).

This innovative school-home curriculum consists, then, of what is learned by students as a result of their experiences at school, at home, in their social interactions with family and peers, and through their use of interactive technologies and other media. It would trivialise the potential advantages of this curriculum to constrain it to what is specified in curriculum documents. Such a view of curriculum assumes that knowledge is actively

constructed through human interaction and engagement with artifacts and resources. Pedagogy is no longer merely a process of teacher-student interaction, but a complex process of interaction between teacher, student, peers, family and technology. Linking home and school via technology may provide an exciting opportunity to support independent learning within a pedagogy of this kind.

A small body of research into the use of technology in the home provided important background evidence for the study. There has been a rapid increase in home ownership of computers in developed countries (Downes, 1998; Facer et al, 2001b; Harrison and Lewin, 2001). By June, 2000 88% of high school students and 83% of elementary students in education authorities in England which are pathfinders in the roll-out of the National Grid for Learning had access to computers out of school, mainly in their own homes (Somekh et al, 2001). There is also considerable case study evidence of children's creativity and technical expertise in their use (Sanger, Wilson and Whittaker, 1997; Downes and Reddacliff 1999; Sutherland et al 2000). A number of studies of the use of technology in school also provided relevant evidence. These included two studies that pre-dated the advent of the internet as a major educational resource, both of which suggested that the impact of technology on learning was disappointing: the Impact evaluation in England (Watson, 1993), and Becker's (2000) review of the use of technology for learning in American schools. Studies of innovative uses of technology in schools included the Pupil Autonomy in Learning with Microcomputers project (Somekh and Davies 1991; Somekh 1997), and the Apple Classroom of Tomorrow project (Sandholtz, Ringstaff and Dwyer 1997), both of which adopted a process/constructivist approach to curriculum and learning. There was also evidence from two evaluation studies of innovative work in the UK involving schools in the use of networked technologies (Scrimshaw 1997) and Impact2 (Harrison et al, 2001).

Studies by Passey (Passey et al 1999, 2000; Passey 2000, 2001) are among the very few that specifically looked at the use of technology for links between home and school. The most obvious barrier to linking home and school in this way is clearly the absence of computers and internet links in a significant minority of students' homes. This is not only a barrier in terms of home use, but also appears to discourage students from using technology at school. A survey carried out at Bristol University in June 2000 showed that of 23% of high school students who did not have access to the internet out of school 41% never used it in school (Somekh et al 2001). Home ownership of computers is often seen as a mechanism for combatting social disadvantage, as in the Buddy and Edison projects (Trotter, 1996). However, Selwyn (1997) and Hargreaves (1997) are among many who believe that technology is likely to increase disadvantage rather than ameliorating it, as a result of an increasing inequality of access, or the 'digital divide'.

Methodology

Government-funded research of this kind feeds directly into policy-making. Following the intensive scrutiny of educational research that surrounded the Hillage report of 1998 (op cit), the current UK government declared its intention to promote 'evidence-based practice'. There is a new openness to looking at evidence and a new commitment to

publish research reports. Within this context we needed to design a research study which would collect evidence that was reliable and produce a report in a form that would command attention (Somekh and Mavers 2001). These data would then provide the basis for meta-analysis to deepen our understanding of the socio-cultural and political issues that drive policies for reform involving technology and shape their outcomes in practice. This two-stage approach to methodology allows us to participate in policy-orientated research at two levels, with the possibility of our work having both short term and long term impact.

The project aimed to gather information on existing content, organisation, management, structure and use of electronic home school links. It explored how technologies are being used to support, sustain and transform current home school link practices. The study objectives were to:

- identify both the types of technologies being used and the various models of use being developed in a range of home-school initiatives (including both established practices and special short-term projects);
- identify the particular benefits that may result;
- investigate the ways in which these benefits may relate not only to teaching and learning but also to the way schools are managed and administered;
- consider a range of software and web based content available in the home that might support home learning;
- consider the implications of these developments for decision makers, schools, LEAs, students and parents;
- consider issues associated with the implementation and management of technology to support home school links;
- consider any further potential benefits of using technology for home-school links which may accrue in the near future as the technology develops.

In this developing field where some English schools are just beginning to explore the use of new technologies for home-school links, our aim was to focus on 'early adopters'. Oral and email consultation with representatives from local education authorities (LEAs), commercial providers and government agencies enabled us to identify schools where innovative practice was evident. This unusual method of selecting the sample was due to our need to identify best practice schools rather than a representative cross-section. Our strategy was to accept all schools that were recommended to us, rather than making inquiries to check the level of their innovative work. Hence there was considerable variation in the level of technological innovation in the schools in the sample.

Questionnaires were distributed in waves, in both electronic and paper-based formats, to more than 200 schools with the aim of securing at least 100 responses. A second survey of six commercial companies, supplemented by telephone interviews and study of their websites, was not intended to be comprehensive but to give an insight into the kinds of services being providing at that time. A half-day consultative seminar held at the end of these project phases enabled us to feed back findings to approximately 100 participants including leaders in technology development work, representatives of commercial hardware and software companies, parents' groups, teachers, local education authority officers, national policy makers and academics. It was also a further opportunity for data

gathering, discussions enabling us to identify benefits, concerns and tensions in the use of technology between home and school.

Eight case study schools were selected from the questionnaire responses as examples of contrasting approaches and practices. Other criteria included geographical spread, schools from different educational phases and the work of a special school. In practice, the larger number of high schools implementing innovative practices made it difficult to select elementary schools. The schools selected were five high schools, one middle school (ages 7-12), one elementary school and a hospital school catering for children whose school is disrupted by injury of illness. An intensive full day (including evening) visit to each school, along with a dossier of information collected from the school, study of the school website and informal email correspondence enabled us to build up a snapshot of practices and to elicit the perceptions of students, parents and school staff. Teachers were interviewed individually. Students (organised into age groups) and parents participated in focus groups and were invited to complete short questionnaires. These methods enabled us to collect facts and perceptions from different groups. We explored:

- the school's existing practices and procedures for home-school links;
- details about school organisation and management of technology to enable and extend home school links;
- types of hardware used in school, at home and elsewhere (including PCs, wireless portable technology, digital television, mobile phones);
- infrastructure in school, at home and elsewhere (including modem, network and broadband);
- resources used in school, at home and elsewhere (to support literacy and numeracy, project work and Key Stage tests);
- email use by students, parents and teachers (how, when and why);
- website use by students, parents and teachers (how, when and why);
- teachers', parents' and students' perceptions of technology in home school links, for example what is considered to be of importance with regard to supporting, enhancing and extending learning.

Due to unforeseen pressures, the elementary school was unable to participate fully and the case study was not completed. Each of the other seven was invited to comment on a detailed report which described and analysed the use of technology for home-school links in their school. These have subsequently been published on the British Educational and Communications Agency (Becta) website (www.becta.org.uk/homeschoollinks).

Evidence of transition

The evidence suggests that the roll-out of networked technologies in the UK educational system has not yet led to radical reform; rather it indicates an educational system in transition. The survey of 115 schools in England, whilst representing early adopters of technology-based innovations, indicated that such schools are in the early and experimental stages of the transformation process. Responses were received from 65 state high schools, 37 state elementary schools, 6 special schools and 7 private schools. The evidence suggests that high schools are more advanced than elementary schools in their use of technology to support links between home and school.

In terms of resourcing, the use of broadband, wireless technologies and portables is developing, particularly in high schools. Not all schools had as yet provided teachers with email addresses (88% indicated teacher email provision) and to a lesser extent with regard to students (65% indicated student email provision), suggesting either insufficient network capacity or concerns about security, e.g. the risk of students being approached by unknown adults. A very small number of schools were experimenting with alternative technological solutions such as digital television and subscription to commercial intranet providers targeting the educational marketplace. 83% of the respondents had a school website. 27% of respondents had provided facilities for students to access school intranet resources from home but only 10% of schools indicated that they actively encouraged students to do so. Portable technologies such as laptops were made available to teachers in 49% of those schools that responded and made available to some (but not all) students in 23% of these schools.

Some respondents indicated that they were engaged in special initiatives to develop links between home and school with technology (44%). Such initiatives included laptop loan schemes, virtual classrooms, homework guidance on the web, emailing parents, emailing homework to teachers, parent clubs, home access to school servers, online tutoring, parental access to school attendance registers via the Internet and online conferencing for parents and school governors. Less than one quarter of schools that responded described initiatives to support students without access to technology at home. Those that did referred to laptop loan schemes, holiday and weekend access to school facilities and priority access to community technology resources.

Email use is less embedded than it might be and there are clearly tensions between efficient communication and management concerns. A third of respondents, although mainly in the high school sector, reported the use of email between students and teachers to support homework practices. 34% of schools encouraged email contact between parents and the school administration staff but only 18% welcomed direct contact between parents and teachers. Reasons given for using email rather than other means of communication included speed, ease of use, flexibility, efficiency, taking pressure off telephone lines, providing a record of communication, actively involving parents and increasing awareness of technology. However, 9% of schools actively discouraged parents from making contact with school administration staff via email because of technical issues, parental expectations of immediate responses, a perceived burden on staff time and concerns about discrimination against those families without access to email at home (the digital divide). In addition, 17% actively discouraged parents from contacting teaching staff directly because of concerns about the digital divide, irregular email use by teachers, a perceived burden on teachers' time and concerns about abuse and invasions of privacy.

School website content is currently influenced by marketing needs and the availability of information that is already in an electronic format. Over two thirds of the respondents indicated that they included on the web site the school prospectus, curriculum information (to a greater extent in high schools than in elementary schools) and general

static information such as school rules, timetables and school dates. 40% of schools indicated that they included direct homework support. 31% of schools included summative student performance data but only 10% provided password protected access to student records of attainment and attendance, this being one of the more recent initiatives to be developed in this area. Almost three quarters of schools indicated that they encourage students to use curriculum revision websites in preparation for statutory tests at ages 7, 11, 14 and 16. Currently, use of school websites is perceived to be the most effective means of developing links between home and school. High schools have made greater advances in this area than elementary schools; many of them have moved beyond simply providing standard information such as timetables and newsletters to the development of interactive learning materials and online homework tutoring.

Initiatives to encourage parental involvement in their children's education included technology training, parental guidance on the use of technology to support homework and open evenings where parents could see how technology is being used to support learning. For example, one elementary school held an *'e-learning evening where over 100 children showed 200 parents what we do with computers in the curriculum.'* Here there was a marked difference between the elementary and high schools, with the former placing greater importance on face-face initiatives such as training, perhaps reflecting the cultural differences between the two educational sectors in England where parents are welcomed within elementary schools throughout the day but may have almost no contact with high schools.

Table 1 indicates the responses of all schools to a question asking what initiatives had been effective in promoting links between home and school using technology.

Table 1: Effective initiatives for home-school links described by schools in order of popularity

Initiative	Total	General reference	Specific reference
Website	25	4	10 for home learning 6 communication and information 2 publishing students' work 3 homework guidelines
Email	12	1	8 communication and information 3 for sending homework
Parental training/family learning	11		
Laptop schemes	6		
Home access of school servers	2		
Open access of technology facilities	2		
Online discussions for parents	1		
Use of video clips to support homework	1		
Online tutoring	1		
Lending library for software	1		
Use of videoconferencing at home to support development of communication skills for SEN students	1		
Use of technology to increase frequency of student reports	1		

The integration of student laptop use into the curriculum has not been as successful to date as hoped. Only six of the 27 schools that were involved in student laptop schemes felt that it had been successful as a means of promoting better links between learning at school and at home. Whilst providing flexible access and enabling work to be transferred between school and home, there were concerns about health and safety because of the weight of machines and fears of mugging, maintenance and technical issues, costs and classroom management particularly when students with laptops were integrated in classes of students without access to such technologies.

Future plans of responding schools include further developments of the school websites including interactive curriculum support materials, facilitating home access to school servers, parental training, increased use of email, introduction of laptop schemes and acquiring broadband connectivity. However, schools were concerned about a number of management issues including equity of access, expertise, time, resources, security and technical issues.

A survey of six commercial providers indicated that supporting learning in the home is seen as an important developing market area. Their interest lies in portable technologies and Internet access including the provision of online resources through education portals and school intranets. Their vision is of 'empowering' students and providing 'seamless learning' between home and school. Whilst primarily targeting schools, they recognise the importance of supporting parents and students at home. The companies are aware of the problems schools face over funding, available infrastructure, technical support and lack of staff time and are able to offer some solutions. Monthly leasing schemes can provide children with laptops, but schools may need special funding to support those families who cannot afford to lease machines themselves. Commercial companies can provide the infrastructure to assist schools with storing large amounts of information and coping with peak-period demands, for example through externally provided services with large-scale facilities, and technical expertise for web hosting, storage and remote access. Through partnership arrangements with schools, out-of-school use of technology can be supported by providing telephone help lines in the evenings and possibly on a 24 hour basis.

Ways of working

Evidence from the case studies demonstrates that technologies being trialled and systems being implemented in innovative schools in England are enabling new ways of working. Transferring work between home and school and accessing curriculum materials is being enabled through networked and more 'traditional' technologies. Students in three of the case study high schools could access their work folders and the school intranet from home over the Internet. Students and teachers with their own wireless laptops who lived within the radius of an aerial in one high school could access school and online resources without the additional costs of telephone calls. Students from all of the five high schools reported emailing files between home and school. Some teachers had also begun to encourage students to submit work via email and a few had started to grade on screen. A

few teachers were also using email to communicate more efficiently with large numbers of students. Students also reported using floppy discs to transfer work between home and school although issues around compatibility, convenience and the need to be well organised arose. For those who borrowed, leased or owned laptops, there was choice about when and how to use the computer. The advanced skills of these students were noted by the students themselves, their parents and their teachers. Teachers also commented on the value of portables to support their own work in lesson planning and material preparation, teaching and administrative work (e.g. assessment and report writing). They felt that laptop ownership improved their confidence and competence with technology. In a hospital case study school, video conferencing had been introduced as a means of bringing the world into the hospital and with an aim of providing teaching by one specialist to students in different locations across the city (e.g. in their homes or back in their regular schools between periods of hospitalisation). Emerging technologies such as mobile phones and digital television, along with other hand held devices promise potentials for the not too distant future. The case studies suggest that, in addition to using the computer for their own leisure pursuits (e.g. games and the Internet), students were largely using technology for neat presentation of work and web research and to a lesser extent for drill and practice (e.g. revision for tests). Many students seemed to be experienced and confident Internet users. Although curriculum materials were still in their infancy, some schools were beginning to consider more systematic approaches to their development.

There are clear advantages in students being able to access their work for continuation, extension and refinement beyond the school walls and the school day. Yet these emergent projects are not without their problems. Participants were very aware of 'digital divide' issues. In response, schools were offering access to computers beyond lesson time and providing after school clubs. One school has more recently lent 'dumb terminals' to Year 11 students without computer access at home. There were also concerns about health and safety in the daily carrying of laptops between home and school (i.e. their weight and dangers of theft or mugging) and their robustness. Anxieties about threats to spelling, handwriting, plagiarism and the demise of books appear to indicate broader sociocultural impacts that are not restricted to schools.

Although some electronic communication between parents and school was evident, evidence from case study schools confirmed the findings of the survey on email. Schools tended to be wary of the additional burdens this might place on teachers. One school was beginning to explore the possibility of electronic registration which automatically sends a text message to parents to alert them about their child's absence. All case study schools had websites, mainly developed in-house. As well as general information for access by parents and prospective parents (e.g. school location, map of the campus, still and live longshot webcam images), one high school had details about departmental organization and staff, the school calendar, performance data and school and community news. The middle school likewise had general information about the school, the school prospectus, a calendar of events, newsletters, curriculum planning, annual test results, homework information, hyperlinks to useful educational sites and students' work. Parental access to assessment information was generally seen as an area for future development.

Examples of innovative practice from the case study schools

a) *Technologies as part of existing cultural discourses and practices*

Computers have had impacts on ways of working and thinking that have brought about significant changes in people's professional and personal lives. Yet technologies enter into already existing cultural discourses and social practices. They are not value-free. There seems to be, therefore, a complex relationship between technologies as shaped and shaping.

In the case study middle school for students aged 7 to 12, children in a special project, who own their own laptops, learn in an environment where teachers have a shared educational vision and where the 'cultural capital' of their homes yields a positive attitude towards learning. Students, teachers and parents spoke about children completing class work at home of their own accord, especially in subjects requiring research such as history, geography or science. One parent saw information handling for project work as '*encouraging children to find out for themselves and that in itself is a learning skill*'. A teacher commented, '*You get them started with an idea and ask them to bring something in the following week. Well I can guarantee the next day I'm getting it back with the class saying "What do you think to this? I found this picture elsewhere, is this more appropriate?" The motivation is incredible*'. In this sense, she said, children drive learning. This suggests innovation and creativity according to the interests of the individual. It also implies a voluntarism in self-initiated curriculum related learning in the home motivated by more prescribed class-based work, and the impacts of the educational ambience of home and school.

An outcome of laptop ownership appears not be to just improved skills but advanced technology capability. In describing children's computer generated project work, one teacher said, '*You'd never know that a child had done them because they're fantastically presented*' and an immensely proud parent spoke of her child's '*amazing*' and '*impressive*' computer skills. The children's capability is evident in their reported ability to make apt choices with regard to appropriate and inappropriate use of their laptops depending on the nature of the task both at home and school. This can lead to discerning use of program facilities. One Year 6 boy (aged 11) said,

'Because on presentations I think that, it sometimes annoys me how people use their presentation to get your attention and not the talking. So I just use the online presentation, just one word without the sounds and stuff like that, and I just talk more than I use the computer [...] it's funny because people with their own laptop do that more than the people who don't [...] because they like showing off with the sound effects and everything to get people's attention. So, yes, so...? So they don't really listen to what you're saying they just like look at the animations. They want to show off basically. They make you look at the pictures and everything. But after a while you get used to the idea of having a laptop; it's just like a normal day thing; you bring it into school, take it home, nothing fussed about it.'

For this boy, the computer had become a medium amongst others used 'transparently' and discriminatingly. What is also interesting is that children want to engage in this kind of critically reflective talk.

Laptops were also used for school-based activities, curriculum related but less directly linked with traditional attainment and associated with personal and leisure interests. For a school assembly, one group of children independently created an electronic version of 'Who wants to be a millionaire' with digital questions and flashing correct answers. At an after school computer club and continued at home, children designed publicity for a summer fair and a performing arts concert. Beyond the pressures of time in school, home access was seen to provide opportunities for exploration. *'And plus, when you take it home, you can learn more stuff for things and you like when we explore like sometimes when I click on something by accident, I learn 'oh is this how that works' and it's like you just explore on the computer. It's like really interesting. There are so many things you can learn'* (Year 6 student, aged 11). This suggests that, for them, there may be fluid boundaries between curriculum and interest related activities although children may not see the latter as learning.

The children spoke about using their laptops at home for games and, in questionnaires, identified use of the web at home for personal interests and leisure pursuits. This implies an ease with which children move between using the computer as a 'toy or tool' (Downes 1997). Young people appear to value the computer for its relevance to their current interests (Buckingham and Sefton-Green 1998; Downes and Reddacliff 1999; Facer *et al.* 2001a). Yet children also share in parental and government discourse about the role of technologies for their future working lives. A Year 7 student (aged 12) commented, *'Thing is, you need to know about laptops to get jobs because they're all to do with computers now, so you've got to know a lot about them'*. There is therefore a sense of being and becoming – the child as an autonomous agent as well as an adult in waiting – a relevance for the present and a vision for the future (James and Prout 1997; Lee 2001).

Access, in the sense that the children have ownership and capability, gives them choice. The children's choice of activity, however, is an outcome of the sociocultural context within which they live. This is constructed by the individual's interest located within a range of discourses, including the school's shared vision and pedagogic approach and educational values in the home. In this situation, children take opportunities to explore and experiment in a range of computer-mediated educational activities and personal interest pursuits, taking control over what they do and how they do it. In such privileged settings, children's creativity, ingenuity and resourcefulness seem to bring together learning for curriculum and leisure purposes which are in some senses discrete yet are not entirely polarized opposites but share threads of knowledge, experience and attitudes. Furthermore, children's self-initiated discussions on ethics, moral values and opinions in themselves demonstrate a concern for these broader citizenship issues.

b) The virtual classroom

In another innovative project in one of the case study schools, an intermediate level IT course is presented through a 'virtual classroom' model where all resources, including lesson notes, worksheets, useful hyperlinks, assignment materials, examples, and guidance, are available on the school website. This has enabled the teacher to focus on individual guidance and support during class lessons. This teacher used technology for lesson preparation prior to this approach and it has not been difficult to adapt and enhance the materials for web presentation. The success of the 'virtual classroom' model, whilst being highly experimental, has inspired other individuals and departments in this school to move forwards in this direction. This model has enabled students to work at their own pace, from home as well as school, '*empowering*' the students, and is now being extended to other courses throughout the school.

Year 13 students (aged 17-18) following an advanced level IT course have also followed this model and one student in particular worked mostly from home after moving 30 miles away from the school. Using messaging software, perceived to be quicker than email and hence more efficient, the student was able to seek online guidance from the class teacher during lesson times; both parties believed that videoconferencing would have improved this communication further. In addition the student was asked to attend particular lessons during which time the teacher made sure that she allocated time to discuss the student's work and progress. This example reveals the potential of learning without walls. Teacher, parents and student firmly believe that success would not have been achieved without this level of support. Despite being behind at the end of the first year of the two year course, this student caught up with his peer group in the space of five months and went on to finish the course ahead of the others. He worked at times that suited him, often into the early hours of the morning and had far more time to devote to his studies at home: '*once you get stuck into it you just want to keep going and going and going.*'

As part of the 'virtual classroom' model the use of email and electronic grading software has been piloted with the Year 13 students but has not been entirely successful because some students were reluctant to move away from traditional assessment systems; they preferred to print out their work. Without the commitment of the whole group the teacher reverted to grading the work by hand, whilst still offering 'e-grading' to students who wanted it. This group has also been involved in an email peer-mentoring project with students in Sweden, commenting on each other's work. This was believed to have contributed to improvements in standards.

Home access to online resources through the Internet and intranet together with student laptop use has begun to make learning more flexible. If online resources are available together with guidance and support from teachers, whether face to face in the classroom or via electronic media, then opportunities for independent learning are maximised and students have more choice and flexibility about how and when to work according to their individual preferences. Many students on these courses have appreciated these benefits. Another student said '*When you get stuck you can get onto the website and get on with it without waiting for the next lesson to come along. You don't get left behind, you can keep up with everybody.*' In this particular school, adopting such a flexible approach to

teaching and learning has led to localised reform. Its success to date has encouraged other staff at the school to consider their current teaching practices and develop their use of technology to support learning beyond the confines of the school wall.

c) Extending the boundaries for gifted and talented students

One of the case study high schools was participating in a special programme for 'gifted and talented' students. The school was located in an urban area and catered for students from families with a wide range of socio-economic backgrounds. The 'gifted and talented' programme was part of a government-funded special initiative called 'Excellence in Cities'. Karen Green, one of the teachers of personal, social and religious education (PSRE) described how she and four students in year 10 (aged 15) were enrolled on a course with the Open University. There were several innovative aspects of this course, which she said she was particularly enjoying. The course was on-line: they had met their university-based tutor four times, but otherwise all the course materials and interactions with the tutor were within the OU's First Class conferencing system.

For a teacher to have a teacher that you never see is quite unusual, but this is where our education on line has opened up a whole new world to me.

Karen and the four students were co-students working together, which meant that their relationships were radically different from those of a traditional teacher and her students. They had regular meetings in school on Tuesday mornings, and when they wanted to have a virtual meeting with their tutor they emailed her to set up the appointment.

We all went on together and we accessed the conference. We were all speaking together and we raised what we were going to do for our next assignment. We were all at home. It was fantastic. It was very exciting for me too. The first time we did it, it was so strange to think that we were all working with people spread across the city and we were all sharing information at the same time but in completely different places.

They had undertaken two individual assignments and were currently planning their third. The first assignment had been a review of web sites and etiquette on the web. The second was to create a web site as a group with each individual producing the material on a particular topic.

Mine was environment and I looked at sustainable energies and renewable energies. Daniel did a piece on foot and mouth as part of current affairs. Another person did one on Sport and on Music. Anita did one on the environment. She was in a different group. Ben did one on current affairs and I've not seen his group's web page.

The gifted and talented programme provided this teacher and a group of 15 year old students with an opportunity for self-directed learning, focusing on topics of their own choosing outside the specified national curriculum. Their learning involved individual project work planned within a group and leading to interactive feed-back from both peers and an on-line tutor. Technology made these opportunities possible, but the focus of each individual's process curriculum was only loosely framed within an agreed syllabus. Each assignment offered opportunities for increasingly extensive choice.

It was clear from Karen's comments quoted here that she was fascinated by the new possibilities that e-learning offered both her and the students. By experiencing it with them as a co-student she also felt she had gained insights which would help her if she

decided to run her own on-line course in the future. There had been a student the previous year who had found it increasingly difficult to come to school for personal reasons and Karen was now wondering if on-line teaching would give her the opportunity to reach students like this at home. At the same time, she was aware from her personal experience as a student of how it felt when 'things go wrong', particularly how difficult it was for the on-line tutor to give them detailed feed-back.

As a teacher in a classroom, I can talk to you, explain, and show you what I want you to do. But on line, virtual space, it's more difficult and I think that would be an issue if we were to do it here. I don't know how it would work, because I think the pupils would still need to come into school to discuss things with us, but I can see how for some children it would be an option.

Broadening access to the curriculum or challenging its nature?

The government's vision is one of broadening access to education for all students and overcoming the endemic under-achievement culturally reproduced by England's embedded system of social class. The dream is that technology will help to achieve this by bringing learning resources into the home and allowing all students to reach the attainment targets for their age group and get good scores in the national curriculum tests. Our research was intended to identify 'models of good practice' which could be replicated in other schools. What did we find?

Although not representative of the national picture, the research revealed the initial experiences of early adopters of technology to support links between school and home. The analysis was based on a substantial body of survey and case study data. A number of schools were already experimenting with a wide range of different initiatives, often in the form of small-scale pilot projects involving enthusiastic staff so that they could identify issues and problems prior to school-wide implementation. In a small number of schools, success with these projects was leading to cultural change and a shift in teaching practices, facilitating improved communication between home and school and a more flexible approach to supporting learning.

Schools were experimenting with the use of technology within the constraints of the existing national curriculum. Technology was entering schools and had created a sense of an education system in transition. However, it was not yet fully embedded and there was a significant gap between the innovative practice claimed for some of the schools by sponsoring companies and the media and the reality that emerged from the survey and case study evidence.

There were some highly innovative examples of practice which were using technology to change the nature of the curriculum, but these all involved exceptional learning for exceptional students – in one case those who had the privilege of owning their own personal laptop as part of a special project funded by a technology company had developed exceptional levels of technology skills and confidence; in another case, students aged 17-18 participating in a specialist advanced level course had experienced a 'virtual classroom' and were able to work at their own pace, without attending the school

on a regular basis, and complete the course successfully, acquiring good final grades; in a third case students selected because they were recognised as specially gifted and talented had taken part in an on-line course which provided them with significant curriculum enrichment and gave them a unique relationship with one of their teachers.

What was interesting about these examples was that at least two out of the three demonstrated a radical shift away from the specified national curriculum to self-directed learning organised around 'structures of ideas, principles and procedures which supported creative imaginative thinking about human experience' (Elliott, 1998, quoted earlier in this paper). They represented a move towards the 'process curriculum'. Technology is itself culturally rich, a medium which promotes and sustains its own messages of anarchic play and exploratory 'surfing'. Efforts in the UK to provide web sites which teach the national curriculum, for example 'revision' sites which offer endless opportunities to self-test and get feed-back on test scores are visited by students from time to time, particularly near the time of public examinations, but it seems unlikely that students will choose to spend much time on these in their own homes. The real gains are much more likely to come from the high levels of motivation students experience in using the internet for leisure purposes such as down-loading music and finding information on topics of their own choice. School work might offer similar experiences, through a re-definition of curriculum as process, in line with the changing definitions of knowledge currently being constructed through internet use in families, workplaces and virtual learning environments. The real gains might thus come in terms of curriculum development away from knowledge specification towards the construction of knowledge. Technology might then become the Trojan horse which, once let into schools, forces upon the education system a break with the current regime of prescribed attainment targets and high stakes testing.

The digital divide and the effects of voluntarism

Although there is a strong possibility that technology will have an impact in promoting radical curriculum reform for some students, it is far less certain that this effect will benefit all students. Indeed, the implication to be drawn from the three examples of innovative practice given above is that their success depended very substantially upon a basic level of socio-cultural 'match' between school and home. They were successful because parents agreed with the school that the project would give their children increased learning opportunities *and* they thought that this was important. They gave their children significant levels of support, in some cases by paying part or the whole of the cost of special equipment, in others through assisting on a regular basis with the transport of heavy laptops between home and school. Drawing on Bourdieu, we can also see that technology use is culturally located and different kinds of use are derived from the individual's 'habitus' (Bourdieu 1977, p. 183-5). Thus, certain kinds of computer use in the home create cultural capital that translates into the economic capital of future careers and life chances, and others do not. Evidence from our research suggests that differential use by students from different socio-cultural backgrounds greatly increases the significant inequities resulting from students' use of technology in the home. While a significant *minority* of students do not have access to the internet at home, a significant

majority do not choose to use technology to help them with their school work on a daily or frequent basis. For example, in the Bristol survey, 59.2% of high school students reported use of a computer for school work with a frequency of once a week or less, while 27.7% reported use two or three times a week and 13.3% reported daily use for school work (Somekh, et al, 2001 p. 13). In all the case study schools, when teachers were questioned about whether they asked students to use a computer for school work at home, they invariably said that they did not because they felt that to do so would disadvantage those students who did not have home access to a computer and/or the internet. It would appear that the unintended consequence of this *de facto* policy is to restrict the significant advantages of frequent use of technology for school work to students whose homes provide high cultural capital. This finding is supported by a study by Hallgarten (2000) which suggests that the UK government's vision of increased partnership between teachers and parents may increase inequities for students, since parents will participate in partnership to very different extents and only a few will be able to provide their children with significant additional support for learning. Hallgarten names 'household choices' as one of the four key factors which shape the educational opportunities of family members, with socio-economic status, family structure and genetic factors as the other three.

Conclusions and educational significance

Our research suggests that the UK government's vision of broadening access to the curriculum through using technology to link home and school is highly problematic. Technology certainly has the potential to extend learning opportunities for all, but its use by students is socio-culturally constructed, leading to reproductions of inequalities between students from homes with differential levels of cultural capital. Schools might be able to combat these inequalities if use of technology to do home work assignments were made obligatory. This depends, however, on removing the basic inequity for students without access to the internet at home. For example, one of our case study schools now provides a network terminal for use at home to all Year 11 students (aged 15-16) who did not already have access, and it is about to extend this to Year 10.

Our research also suggests that technology cannot easily be integrated into current patterns of curriculum and pedagogy because it is not a 'neutral' value-free tool. Technology is a communication medium and, as McLuhan said, 'the medium models the message'. The internet is already embedded in, and embeds, youth culture. For students it is often first and foremost a leisure environment and a source of downloaded music and images. It is also a source of enormous quantities of information of varying quality and accuracy, made available by numerous providers driven by every possible motive known to human beings. The term 'surfing' provides a powerful metaphor for the kind of use it invites. It is an exploratory and often fundamentally playful medium which can empower users very significantly by giving them access to knowledge (e.g. of medicine and the law) and a platform for publishing their views (e.g. the organisation of global protests). For the internet to become a means of broadening access to the curriculum, the nature of the curriculum would have to change. The transmission of large quantities of pre-specified knowledge followed by high profile national tests to ensure that students meet

attainment targets is an approach to curriculum and pedagogy that can never maximise the benefits of this medium. The real benefits come, as shown in our case study examples, when the use of technology is coupled with a shift in the nature of the curriculum towards a focus on critical thinking and what Polanyi (1958) called 'passionate participation in the act of knowing'. Technology could provide very significant support for the process curriculum and exploratory pedagogy described by Bruner, Stenhouse and Elliott.

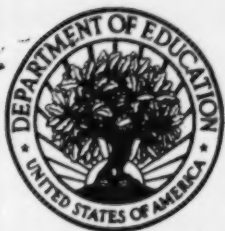
In the US, the impact of technology on the curriculum for academic subjects has continued to be disappointing (Becker 2000). This paper raises issues of importance for curriculum theorists, teachers and policy-makers. The current tensions between neo-liberal aspirations for equity and social justice and the market-oriented audit culture underpinning tightly prescribed curricula and extensive testing regimes needs to be addressed. Technology is bringing about radical changes in all other areas of society. If it has the potential to radically improve schooling we should capitalise on what it has to offer, but to do so the very nature of the curriculum needs to be challenged.

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